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Severe Conjunctivitis Associated with *Chlamydia felis* Infection in a Free-ranging Eurasian Lynx (*Lynx lynx*)

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ABSTRACT: A free-ranging adult Eurasian lynx (*Lynx lynx*) captured in Switzerland presented with a severe purulent unilateral conjunctivitis. *Chlamydia felis* was detected in conjunctival swabs by qPCR. Systemic treatment with oxytetracycline and ketoprofen led to complete recovery. Infection with *C. felis* has not been previously reported in Eurasian lynx.

Chlamydia felis is an obligate intracellular bacterium and is the organism most-frequently associated with infectious conjunctivitis in domestic cats (*Felis silvestris catus*; Dean et al. 2005; Gruffydd-Jones et al. 2009). After 2–5 d incubation, clinical signs typically include a marked hyperemia of the nictitating membrane, prominent chemosis, blepharospasm, and ocular discharge (Gruffydd-Jones et al. 2009; Berris et al. 2015). They often start unilaterally but become bilateral after a few days. Chlamydiosis in cats can additionally be associated with fever, infection of the upper respiratory tract, pneumonia, and reproductive disorders (Gruffydd-Jones et al. 2009).

In wild felids, antibodies against *Chlamydia* spp. have been documented in free-ranging Iberian lynx (*Lynx pardinus*), European wildcats (*Felis silvestris silvestris*), and captive tigers (*Panthera tigris*; Millán and Rodríguez 2009; Millán et al. 2009; Berris et al. 2015) but not in mountain lions (*Puma concolor*) and Pallas cats (*Felis manul*; Paul-Murphy et al. 1994; Naidenko et al. 2014). *Chlamydia felis* was detected by PCR in a free-ranging Iberian lynx and a captive ocelot (*Leopardus pardalis*; Meli et al. 2009; Seki et al. 2016) without mention of any associated clinical signs. The avian immunotype of *C. psittaci* was found in the altered organs of a captive fishing cat (*Prionailurus viverrinus*) that died after showing depression and tremor (Kik et al. 1997). Here we report a case of conjunctivitis associated with *C. felis* infection in a free-ranging Eurasian lynx (*Lynx lynx*).

In March 2017, an adult female Eurasian lynx was caught for a translocation program in the Jura Mountains, Switzerland, using a box trap and an intramuscular injection of 0.17 mg/kg medetomidine (Domitor, 1 mg/mL, Orion-Corporation, Espoo, Finland) and 4.9 mg/kg ketamine hydrochloride (Ketasol, 100 mg/mL, Graeub AG, Bern, Switzerland). The animal presented with a marked unilateral conjunctivitis of the left eye characterized by hyperemia, prominent chemosis, and yellowish, turbid, mucopurulent discharge (Fig. 1). There was no visible injury of the ocular structures, and the fluorescein stain test was negative, but two, crust-covered scratches on the nose suggested a recent facial trauma. The right eye appeared healthy. The lynx was in good body condition (16.2 kg) and had a shiny clean hair coat and a full stomach. Body temperature (38.7 C), lung, and heart auscultation were unremarkable. We suspected a bacterial conjunctivitis of traumatic origin. According to our translocation protocol, we collected blood as well as conjunctival, oropharyngeal, and rectal dry swabs. We rinsed the diseased eye with sterile NaCl solution and administered 8 mg/kg cefovecin (Convenia®, 80 mg/mL, Zoetis, Zurich, Switzerland) subcutaneously. Medetomidine was antagonized with 0.86 mg/kg atipamezol (Antisedan, 5 mg/mL, Orion-Corporation, Espoo, Finland) and the lynx was brought to a quarantine enclosure.

Conjunctival swabs were positive for *C. felis* by qPCR (cycle threshold [Ct] values of 27 in the affected versus 39 in the apparently healthy eye, or almost 4,000 times more

FIGURE 1. Left eye of an adult female Eurasian lynx (*Lynx lynx*) at the time of capture in March 2017 in the Swiss Jura Mountains. The lynx presented with a severe conjunctivitis characterized by hyperemia and prominent chemosis together with yellowish, turbid, mucopurulent ocular discharge.

bacterial DNA in the affected eye than in the unaffected eye) while PCRs for feline herpesvirus-1 (FHV-1) and *Mycoplasma felis* were negative (Meli et al. 2009; Söderlund et al. 2011). The PCRs for feline calicivirus (FCV), canine distemper virus (oropharyngeal swab), parvovirus, feline coronavirus (rectal swab), and feline leukemia provirus (FeLV; blood) were negative (Meli et al. 2009). Western blot for feline immunodeficiency virus antibodies and enzyme-linked immunosorbent assay (ELISA) for FeLV p27 antigen were negative (Lutz et al. 1988). Hematology and blood chemistry did not reveal abnormalities compared to apparently healthy, free-ranging lynx from Switzerland.

The available data pointed at a chlamydial conjunctivitis. An intramuscular injection of 9.7 mg/kg oxytetracycline (Engemycin®, 100 mg/mL, MSD Animal Health, Luzern, Switzerland) mixed with 1.8 mg/kg ketoprofen (Dinalgen®, 150 mg/mL, Graeub AG, Bern, Switzerland) was administered by blowpipe every second day over a period of 8 d. Initial signs of severe blepharospasm, anorexia, and apathy progressively resolved and by the end of the treatment, the lynx appeared healthy. It was re-examined and resampled under anesthesia 14 d postcapture. Both eyes were clinically inconspicuous and body condition was good (16.5 kg). No tissue irritations related to the oxytetracycline injections were observed. Conjunctival swabs were PCR-negative for *C. felis*. The lynx was fitted with a global positioning system (GPS) radiocollar and released into the wild. It was photographed with a camera-trap 3 mo later and

appeared in good body condition, with a normal left eye.

Here we have reported a novel case of a *C. felis* infection with associated conjunctivitis in a free-ranging wild felid. A higher load of *C. felis* DNA was detected in the affected left than in the healthy right eye, suggesting a recent bacterial spread from left to right. The observed ocular signs, the rapid clinical improvement under appropriate treatment, and the absence of FHV-1, FCV, and *M. felis* supported the etiologic role of *C. felis*. In domestic cats with ocular chlamydiosis, spontaneous remissions occur (Gruffydd-Jones et al. 2009), but short treatment periods can result in chronic persistent infections and recurrence of clinical signs (Dean et al. 2005). In this lynx, the negative PCR results obtained 9 d after the first oxytetracycline injection and the inconspicuous picture 3 mo after release suggested a complete recovery.

The source of infection was unknown. Natural transmission occurs by close contact, with ocular secretions playing a key role (Gruffydd-Jones et al. 2009; Berris et al. 2015; Seki et al. 2016). Nevertheless, Chlamydiaceae can survive in the environment for a limited time, making indirect infection possible (Horzinek et al. 2005). Considering the apparently isolated occurrence in a lynx, a spill-over from a domestic cat (*Felis catus*) or European wildcat is a potential explanation. Both domestic cats and European wildcats share the range of lynx in the Jura Mountains (Hercé 2011). Direct contacts between lynx and cats occasionally occur by predation (Jobin et al. 2000). Shared-scent marking sites might provide opportunities for indirect contacts. As yet, no data on the exposure of Eurasian lynx to *C. felis* are available, and investigations on the occurrence of *Chlamydia* spp. in sympatric felids are necessary to draw conclusions about the infection dynamics. This case highlights the benefit of a quarantine period to treat and prevent the spread of infectious diseases when translocating wildlife.

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